FORM PTO-1390 (REV 11-2000)	U S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY'S DOCKET NUMBER 35-233
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		U S APPLICATION NO (If known, see 37 C F R 1 5) 10/089047
INTERNATIONAL APPLICATION NO. PCT/EP00/07379	INTERNATIONAL FILING DATE 31/07/2000	PRIORITY DATE CLAIMED 24/09/1999

TITLE OF INVENTION

DATA MEMORY

APPLICANT(S) FOR DO/EO/US

LEIBER, J. et al.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. ☐ The U.S. has been elected by the expiration of 19 months from the priority date (Article 31).
5. A copy of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. ☐ is attached hereto (required only if not communicated by the International Bureau).
   b. ☒ has been communicated by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. ☒ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   b. ☐ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has **NOT** expired.
   d. ☐ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 To 20 below concern document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.
14. ☐ A SECOND or SUBSEQUENT preliminary amendment.
15. ☐ A substitute specification.
16. ☐ A change of power of attorney and/or address letter.
17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821-1.825.
18. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. ☒ Other items or information. PTO Form 1449

U.S. PTO 10/089047	INTERNATIONAL APPLICATION NO PCT/EP00/07379	ATTORNEY'S DOCKET NUMBER 35-233

21. - ☒ The following fees are submitted:

	CALCULATIONS	PTO USE ONLY

BASIC NATIONAL FEE (37 C.F.R. 1.492(a)(1)-(5):

-- Neither international preliminary examination fee (37 C.F.R. 1.482) nor international search fee (37 C.F.R. 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO $1040.00

-- International preliminary examination fee (37 C.F.R. 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO $890.00

-- International preliminary examination fee (37 C.F.R. 1.482) not paid to USPTO but international search fee (37 C.F.R. 1.445(a)(2)) paid to USPTO $740.00

-- International preliminary examination fee (37 C.F.R. 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) $710.00

7 International preliminary examination fee (37 C.F.R. 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) $100.00

ENTER APPROPRIATE BASIC FEE AMOUNT = $ 890.00

Surcharge of $130.00 for furnishing the oath or declaration later than ☐ 20 ☒ 30 months from the earliest claimed priority date (37 C.F.R. 1.492(e)). $ 130.00

CLAIMS	NUMBER FILED		NUMBER EXTRA	RATE			
Total Claims	13	-20 =	0	X	$18.00	$	0.00
Independent Claims	1	-3 =	0	X	$84.00		0.00
MULTIPLE DEPENDENT CLAIMS(S) (if applicable)					$280.00	$	0 00
CLAIM FEES ARE NOT BEING PAID AT THIS TIME				**TOTAL OF ABOVE CALCULATIONS =**		$	**1020.00**

☐ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2. 0.00

SUBTOTAL = $ **1020.00**

Processing fee of $130.00, for furnishing the English Translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 C.F.R. 1.492(f)). + 0.00

TOTAL NATIONAL FEE = $ **1020.00**

Fee for recording the enclosed assignment (37 C.F.R. 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 C.F.R. 3.28, 3.31). **$40.00** per property + $ 0.00

Fee for Petition to Revive Unintentionally Abandoned Application ($1280.00 – Small Entity = $640.00) $ 0.00

TOTAL FEES ENCLOSED = $ **1020.00**

Amount to be: refunded $

Charged $

a. ☒ A check in the amount of $1020.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. 14-1140 in the amount of $_____ to cover the above fees. A duplicate copy of this form is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 14-1140. A duplicate copy of this form is enclosed.

d. ☒ The entire content of the foreign application(s), referred to in this application is/are hereby incorporated by reference in this application.

NOTE: Where an appropriate time limit under 37 C.F.R. 1.494 or 1.495 has not been met, a petition to revive (37 C.F.R. 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

NIXON & VANDERHYE P.C.
1100 North Glebe Road, 8th Floor
Arlington, Virginia 22201-4714
Telephone: (703) 816-4000

SIGNATURE

Arthur R. Crawford
NAME

25,327 REGISTRATION NUMBER

March 25, 2002 Date

613977

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of

LEIBER, J. et al.

Serial No. unknown

Filed: March 25, 2002

For: DATA MEMORY

Atty. Ref.: 35-233

Group:

Examiner:

* * * * * * * * * * *

March 25, 2002

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

PRELIMINARY AMENDMENT

In order to place the above-identified application in better condition for examination, please amend the application as follows:

IN THE SPECIFICATION

Please substitute the following paragraphs in the specification for corresponding paragraphs previously presented. A copy of the amended specification paragraphs showing current revisions is attached.

Page 1, before the first line, please insert as a separate paragraph:

This application is the US national phase of international application PCT/ep00/07379 filed 31 July 2000, which designated the US.

IN THE CLAIMS

Please substitute the following amended claims for corresponding claims previously presented. A copy of the amended claims showing current revisions is attached.

4. The data storage medium as claimed in claim 1, characterized in that the polymer carrier (11), which preferably comprises a polymer film (11), is wound spirally around the core (30).

5. The data storage medium as claimed in claim 1, characterized in that the core (30; 40) comprises a plastic.

7. The data storage medium as claimed in claim 5, characterized in that the core (30; 40) is provided with an antiscratch coating.

8. The data storage medium as claimed in claim 1, characterized in that the core (30; 40) comprises a glass.

9. The data storage medium as claimed in claim 1, characterized in that there is an adhesion layer (12) between each pair of adjacent polymer carrier plies (10).

11. The data storage medium as claimed in claim 1, characterized in that the refractive index of the polymer carrier (11) can be changed locally by heating.

13. The use of a data storage medium as claimed in claim 1 in conjunction with claim 3 in a drive which is attuned to it and comprises a read device (2) and, optionally, a write device (2), the read device (2) and the optional write device (2) being disposed in the recess (32) in the central area of the core (30) and being moved relative to the data storage medium (1), while the data storage medium (1) is stationary, for the purpose of reading and/or writing information.

REMARKS

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page(s) is captioned "**Version With Markings To Show Changes Made**."

Respectfully submitted,

NIXON & VANDERHYE P.C.

By: _____

Arthur R. Crawford
Reg. No. 25,327

ARC:ecb
1100 North Glebe Road, 8th Floor
Arlington, VA 22201-4714
Telephone: (703) 816-4000
Facsimile: (703) 816-4100

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION

Page 1, before the first line, please insert as a separate paragraph:

This application is the US national phase of international application PCT/ep00/07379 filed 31 July 2000, which designated the US.

IN THE CLAIMS

4. The data storage medium as claimed in ~~any of~~ claim~~s~~ 1 ~~to~~ 3, characterized in that the polymer carrier (11), which preferably comprises a polymer film (11), is wound spirally around the core (30).

5. The data storage medium as claimed in ~~any of~~ claims 1 ~~to~~ 4, characterized in that the core (30; 40) comprises a plastic.

7. The data storage medium as claimed in claim 5 ~~or 6~~, characterized in that the core (30; 40) is provided with an antiscratch coating.

8. The data storage medium as claimed in ~~any of~~ claims 1 ~~to~~ 4, characterized in that the core (30; 40) comprises a glass.

9. The data storage medium as claimed in ~~any of~~ claims ~~1 to 8~~, characterized in that there is an adhesion layer (12) between each pair of adjacent polymer carrier plies (10).

11. The data storage medium as claimed in ~~any of~~ claims ~~1 to 10~~, characterized in that the refractive index of the polymer carrier (11) can be changed locally by heating.

13. The use of a data storage medium as claimed in ~~any of the preceding~~ claims 1 in conjunction with claim 3 in a drive which is attuned to it and comprises a read device (2) and, optionally, a write device (2), the read device (2) and the optional write device (2) being disposed in the recess (32) in the central area of the core (30) and being moved relative to the data storage medium (1), while the data storage medium (1) is stationary, for the purpose of reading and/or writing information.

Certification of Translation

I, Georg Both of UEXKÜLL & STOLBERG, Patent Attorneys in Hamburg, Germany, do hereby certify that I am conversant with the English and German languages and am a competent translator thereof, and I further certify that to the best of my knowledge and belief the attached English language document is a true and correct translation of International Patent Application No. PCT/EP00/07379 filed on July 31, 2000.

Hamburg, February 20, 2002

(G. Both)

1/prts

Data storage medium

The invention relates to a data storage medium having an optical information carrier which comprises a plurality of plies of a polymer carrier.

DE 298 16 802 describes a data storage medium having an optical information carrier which comprises a polymer carrier in the form of a polymer film. Material specified for the polymer film includes polymethyl methacrylate and also a polymer film which is sold by Beiersdorf AG under the designation "tesafilm kristallklar" and comprises biaxially oriented polypropylene. The polymer film is wound in a plurality of plies onto a core in a spiral fashion, with an adhesion layer being located between each pair of adjacent plies. Information can be written to this data storage medium by locally heating the polymer film by means of a write beam of a data drive, as a result of which the refractive index and thus the reflecting power (reflectivity) change locally at the interface of the polymer film. This can be detected by means of a read beam in the data drive. By focussing the write beam or read beam, information can be specifically written to or read from a preselected ply of the information carrier. The core may be optically transparent and may have a recess in its central area that serves to accommodate the read/write device of a data drive. The read/write device is moved relative to the data storage medium, while the data storage medium is stationary, so that the data storage medium need not be balanced to take account of a rapid rotational motion.

In the existing data storage medium, the core is of polystyrene. Polystyrene is not particularly scratch-resistant and has a refractive index (1.59 at the wavelength of the read beam used) which differs markedly from that of the polymer film material (1.49

for biaxially oriented polypropylene at the wavelength of the read beam). Since, when the data storage medium is used in a data drive whose read/write device is situated in the recess of the core, the wall of the core is required to transmit the read beam and write beam (and to do so two times during each read operation), poor optical quality as a result of scratches, and particularly the reflection losses associated with the sizeable difference in refractive index, have particularly unfavorable consequences.

It is an object of the invention to provide a data storage medium having an optical information carrier which comprises a plurality of plies of a polymer carrier, in which the disadvantages set out above and attributable to an inadequate core do not arise.

This object is achieved by means of a data storage medium having the features of claim 1. Claim 13 relates to the use of such a data storage medium in a drive that is attuned to it. Advantageous embodiments of the invention follow from the dependent claims.

The data storage medium of the invention has an optical information carrier which comprises a plurality of plies of a polymer carrier through which information can be read from a preselected polymer carrier ply and, optionally, can be written to a preselected polymer carrier ply. The information carrier is formed around an optically transparent core whose refractive index differs by less than 0.08 from the refractive index of the polymer carrier. These refractive indices are based on the light wavelength at which the optical read device of a drive attuned to the data storage medium operates.

As a result of the relatively small difference in the refractive indices of the optical transparent core and of the polymer carrier, a read beam emitted by the read

device of a drive and transmitted by the optically transparent core is able to penetrate into the polymer carrier without being reflected too greatly at the interfaces between the core and the polymer carrier. Such reflections are disadvantageous since they, firstly, attenuate the read beam and, secondly, induce a severe background level which is superimposed on the actual read signal. Similar comments apply to a write beam, if the data storage medium is, optionally, disposed as a data storage medium which can be written by the user. The smaller the difference in the refractive indices, the smaller the reflections. If the data storage medium has one or more additional layers between adjacent polymer carrier plies (see below), the refractive index of an additional layer ought also to differ only slightly from the refractive index of the polymer carrier.

The core is preferably sleevelike or cylinderlike and has a recess in its central area. This reference is intended to embrace designs in which the periphery of the core is not circular in cross section but instead has a step, so that the core is better adapted to the contour of the polymer carrier plies adjacent to the core. This is elucidated later on below with reference to an embodiment example.

The recess in the central area of the core can be disposed to accommodate a read device and, optionally, a write device of a drive that is attuned to the data storage medium. It is particularly advantageous to use the data storage medium in a drive which comprises a read device and, optionally, a write device, the read device and the optional write device being disposed in the recess in the central area of the core and being moved relative to the data storage medium, while the data storage medium is stationary, for the purpose of reading and/or writing information. In this case, there is no need to balance the data storage medium in order

to permit high rotational speeds, which has favorable consequences for the production costs.

In one advantageous design of the invention, the polymer carrier, which preferably comprises a polymer film, is wound spirally around the core. With this kind of multi-ply construction of the data storage medium it is possible to obtain a very high storage density. For example, from 10 to 30 polymer film plies may be wound atop one another, or else a greater or lesser number. At a polymer film thickness of between 10 µm and 100 µm, preferably below 50 µm or around 35 µm, the information on different polymer film plies can be separated from one another with good resolution by means of read/write devices which are known, for example, from DVD technology. It is, however, also conceivable for the polymer carrier, instead of being wound spirally around the core, to have, for example, a plurality of its plies, extending substantially concentrically, arranged around the core.

The core may comprise a plastic. As the core material it is preferred to employ a plastic of optically high quality. The refractive index of the plastic material must be situated within the range of the refractive index of the polymer carrier. Accordingly, suitable examples include polymethyl methacrylate (PMMA) or a cycloolefinic copolymer sold by Nippon Zeon under the designation "Zeonex", particularly if a biaxially oriented polypropylene (BOPP; see below) polymer film is used for the polymer carrier.

If the core comprises a plastic or consists entirely of plastic, the core is preferably provided with an antiscratch coating. Antiscratch coatings of this kind, which are known, for example, from spectacle optics, prevent, at least substantially, scratching of the surfaces of the core that are exposed to a read beam or write beam, thereby increasing the operational

reliability and life time of the data storage medium. In this case it must be ensured that the antiscratch coating does not result in a large shift in refractive index.

The core may also comprise a glass. Glasses generally have a better optical quality and higher scratch resistance than plastics. A glass core also has mechanical advantages, since a data storage medium having such a core is difficult to deform. One type of glass suitable particularly for use with a polymer carrier comprising biaxially oriented polypropylene is the glass sold by Schott under the designation "BK7".

There is preferably an adhesion layer arranged between each pair of adjacent polymer carrier plies, in order to fix the polymer carrier plies to one another. An adhesion layer may, for example, have a thickness in the range between 1 µm and 40 µm, preferably below 25 µm or around 2 µm. A suitable adhesion agent comprises, for example, an acrylate adhesive which is free from air bubbles and which is crosslinked, for example, chemically or by irradiation with UV or electron beams. Between adjacent polymer carrier plies it is also possible for there to be one or more layers having other functions or additional functions, e.g., a layer containing dye molecules of an absorber (see below).

Preferably, the refractive index of the adhesion layer differs only slightly from the refractive index of the polymer carrier, in order to minimize disruptive reflections of the read beam or of the write beam at a boundary between a polymer carrier ply and an adjacent adhesion layer. It is particularly advantageous if the difference in the refractive indices is less than 0.005. Any difference in the refractive indices may, however, be utilized for the purpose of formatting the data storage medium.

In one preferred embodiment of the data storage medium of the invention, the refractive index of the polymer carrier can be changed locally by heating. Suitable material for the polymer carrier comprises, for example, a polymer film of biaxially oriented polypropylene (BOPP), although other materials can also be used. If polypropylene, following extrusion to the film, is pretensioned in two planes, a high inherent energy is stored in the material. In the case of local heating, by means of a write beam, for example, there is a severe change in the material by reverse deformation, and this is so even when a relatively small amount of energy is deposited per unit area. In this way it is possible, for example, to achieve a change in refractive index of approximately 0.2 over an area for one stored information unit with a diameter or side length of approximately 1 µm, and this is readily detectable by means of a read beam.

The polymer carrier may be assigned an absorber which is disposed at least partly to absorb a write beam and to emit the generated heat at least partly, locally, to the polymer carrier. The absorber comprises, for example, dye molecules which are present, for example, in the polymer carrier or in an adhesion layer adjacent to the polymer carrier, and permits local heating of the polymer carrier, sufficient to change the refractive index, for a relatively low write beam intensity.

In the text below, the invention is elucidated further with reference to embodiment examples. The drawings show, in

Figure 1, a data storage medium of the invention which comprises a spiral-wound polymer film, in diagrammatic perspective representation, parts of a drive attuned to the data storage

medium being arranged in a recess in the central area of the data storage medium;

Figure 2, a diagrammatic cross section through the data storage medium of figure 1, and

Figure 3, a diagrammatic cross section through the central area of a data storage medium having a core whose periphery is of a different design from that in figure 2.

Figure 1 shows in diagrammatic representation a data storage medium 1 and a read/write device 2 of a drive attuned to the data storage medium 1. The data storage medium 1 comprises a number of plies 10 of a polymer carrier in the form of a polymer film 11 which serves as information carrier and is wound spirally around an optically transparent core. For clarity, the core is not shown in figure 1; it is located within the innermost ply 10 and is described in more detail later on with reference to figure 2. For ease of illustration, the individual plies 10 of the polymer film 11 have been shown in figure 1 as concentric rings, although the plies 10 are formed by spiral winding of the polymer film 11. Between each pair of adjacent plies 10 of the polymer film 11 there is an adhesion layer 12. For reasons of clarity, the adhesion layers 12 have been drawn in figure 1 in an increased thickness which is not to scale.

In the embodiment example, the polymer film 11 consists of biaxially oriented polypropylene and has been pretensioned in both surface directions prior to winding. In the embodiment example, the polymer film 11 has a thickness of 35 µm; other thicknesses in the range from 10 µm to 100 µm or even thicknesses lying outside of this range are likewise conceivable. The adhesion layers 12 are free from gas bubbles and in the embodiment example consist of acrylate adhesive, to

which an absorber dye has been admixed, at a thickness of 23 µm, preferred layer thicknesses being between 1 µm and 40 µm. In the embodiment example, the data storage medium 1 contains twenty plies 10 of the polymer film 11 and has an external diameter of approximately 30 mm. Its height is 19 mm. A different number of plies 10, or different dimensions, are likewise possible. The number of windings or plies 10 may, for example, be between ten and thirty, or else may be greater than thirty.

The read/write device 2 arranged in a recess in the central area of the data storage medium 1 comprises a read/write head 20 which can be moved backward and forward axially and rotated in the directions of the arrows that have been drawn in, by means of a mechanism 21. The read/write head 20 has optical elements by means of which a light beam (of wavelength, for example, 630 nm or 532 nm) produced by a laser, which is not shown in figure 1, may be focussed onto the individual plies 10 of the polymer film 11. Since the read/write head 20 is moved by means of the mechanism 21, it is able to scan fully all plies 10 of the data storage medium 1. In the embodiment example, the data storage medium 1 is stationary. Consequently, it does not need to be balanced to take account of a high rotational speed (and also need not be unwound or rewound), unlike the read/write head 20. For the sake of clarity, the elements provided for balancing the read/write head 20 have not been shown in figure 1. The laser mentioned is located outside of the read/write head 20 and is stationary; the laser beam is guided into the read/write head 20 via optical elements.

In the embodiment example, the laser is operated with a beam power of approximately 1 mW for the purpose of storing or writing information in or to the data storage medium 1. The laser beam serves here as a write beam and is focussed onto a preselected ply 10 of the

polymer film 11, in such a way that the beam spot is smaller than 1 µm, the light energy being introduced in the form of short pulses of approximately 10 µs in duration. The energy of the write beam is absorbed in the beam spot, promoted by the absorber in the adjacent adhesion layer 12, leading to a local heating of the polymer film 11 and thus to a local change in the refractive index and in the reflectivity.

In order to read stored information from the data storage medium 1, the laser is operated in continuous wave mode (CW mode). The read beam focussed onto the desired site is reflected as a function of the stored information, and the intensity of the reflected beam is detected by a detector in the read/write device 2.

The data storage medium may also be of an embodiment which cannot be written by the user. In this case, it contains information units written by the manufacturer. There is then no need for a write function in the user's data drive.

In the polymer film 11, the information units are formed by changing the optical properties in a region having a preferred size of less than 1 µm. The information may be stored in binary form; i.e., the local reflectivity adopts only two values at the site of one information unit. In other words, if the reflectivity is above a fixed threshold value, a "1", for example, is stored at the site in question on the information carrier, and, if it is below this threshold value or below a different, lower threshold value, a "0" is correspondingly stored. It is, however, also conceivable for the information to be stored in a plurality of gray stages. This is possible if the reflectivity of the polymer film at the site of an information unit can be changed specifically by defined adjustment of the refractive index without saturation being reached.

Figure 2 shows a diagrammatic cross section through the data storage medium from figure 1. The core, designated here by 30, is in the shape of a sleeve or hollow cylinder and has a recess 32 in its central area. The recess 32 can accommodate the read/write device 2 of the drive; see figure 1. The optical information carrier with the spiral-wound polymer film 11 and the adhesion layers 12 extends from the external periphery 34 of the core 30 to an external periphery 36.

In the embodiment example, the core 30 is made of polymethyl methacrylate (PMMA). It can be produced by injection molding or extrusion. Afterward, preferably, the surface of the core 30 that bounds the recess 32 is provided with an antiscratch coating.

Examples of other materials for the core are a cycloolefinic copolymer marketed by Nippon Zeon under the designation "Zeonex", or else other plastics. Particularly advantageous are glasses, e.g., the glass having the designation "BK7" from Schott.

It is essential that the refractive index of the material for the core is in accord with the refractive index of the polymer carrier. Accordingly, at a light wavelength of 630 nm (i.e., a light wavelength relevant for a read beam or write beam), biaxially oriented polypropylene has a refractive index of 1.503, while the refractive index of polymethyl methacrylate is 1.491, that of "Zeonex" 1.522, and that of glass "BK7" 1.515. In all cases, therefore, the difference between the refractive indices is small.

The data storage medium whose central area is shown in a diagrammatic cross section in figure 3 has a core 40 whose form is somewhat different to that of the data storage medium elucidated with reference to figures 1 and 2. The core 40 has a cylindrical recess 41 for accommodating a read/write device and a drive. The

outer contour 42 of the core 40, however, is not circular, as in figure 2, but is instead spiral in form and has a step 43. The height of the step 43, i.e., the size of the radial projection of the outer contour 42 at the step 43, is adapted to the thickness of the polymer film referred to here as 44 (including adjacent adhesion layer) which is wound onto the core 40.

Figure 3 shows how the inner end 45 of the polymer film 44 (with adhesion layer) is situated at the step 43. The innermost ply 46 of the polymer film 44 bears via the adhesion layer against the outer contour 42 of the core 40. At the beginning of the following ply, 47, the step 43 ensures that the polymer film 44 extends largely on an ideal spiral, as can be seen from figure 3. In particular, an abrupt projection in the radial direction is prevented, as occurs in the case of a core with a circular periphery, e.g., the core 30, if at the beginning of the second wind the polymer film strikes the inner end which marks the beginning of the first wind. In particular, the inner winds of the spirallike arrangement of the polymer film 44 have, as a result, a relatively uniform course, so that the focus of a read beam or write beam can be guided more effectively.

Claims

1. A data storage medium having an optical information carrier which comprises a plurality of plies (10) of a polymer carrier (11) through which information can be read from a preselected polymer carrier ply (10) and, optionally, can be written to a preselected polymer carrier ply (10) and which is formed around an optically transparent core (30) whose refractive index differs by less than 0.08 from the refractive index of the polymer carrier (11).

2. The data storage medium as claimed in claim 1, characterized in that the core (30) is sleevelike or cylinderlike and has a recess (32) in its central area.

3. The data storage medium as claimed in claim 2, characterized in that the recess (32) is disposed to accommodate a read device (2) and, optionally, a write device (2) of a drive that is attuned to the data storage medium (1).

4. The data storage medium as claimed in any of claims 1 to 3, characterized in that the polymer carrier (11), which preferably comprises a polymer film (11), is wound spirally around the core (30).

5. The data storage medium as claimed in any of claims 1 to 4, characterized in that the core (30; 40) comprises a plastic.

6. The data storage medium as claimed in claim 5, characterized in that the core (30; 40) comprises one or more of the following materials: polymethyl methacrylate, cycloolefinic copolymer.

7. The data storage medium as claimed in claim 5 or 6, characterized in that the core (30; 40) is provided with an antiscratch coating.

8. The data storage medium as claimed in any of claims 1 to 4, characterized in that the core (30; 40) comprises a glass.

9. The data storage medium as claimed in any of claims 1 to 8, characterized in that there is an adhesion layer (12) between each pair of adjacent polymer carrier plies (10).

10. The data storage medium as claimed in claim 9, characterized in that the refractive index of the adhesion layer (12) differs only slightly from the refractive index of the polymer carrier (11).

11. The data storage medium as claimed in any of claims 1 to 10, characterized in that the refractive index of the polymer carrier (11) can be changed locally by heating.

12. The data storage medium as claimed in claim 11, characterized in that the polymer carrier (11) is assigned an absorber which is disposed at least partly to absorb a write beam and to emit the generated heat at least partly, locally, to the polymer carrier (11).

13. The use of a data storage medium as claimed in any of the preceding claims in conjunction with claim 3 in a drive which is attuned to it and comprises a read device (2) and, optionally, a write device (2), the read device (2) and the optional write device (2) being disposed in the recess (32) in the central area of the core (30) and being moved relative to the data storage medium (1), while the

data storage medium (1) is stationary, for the purpose of reading and/or writing information.

Abstract

A data storage medium has an optical information carrier which comprises a plurality of plies (10) of a polymer carrier (11) through which information can be read from a preselected polymer carrier ply (10) and, optionally, written to a preselected polymer carrier ply (10). The information carrier is formed around an optically transparent core whose refractive index differs by less than 0.08 from the refractive index of the polymer carrier (11).

(Figure 1)

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro

(43) Internationales Veröffentlichungsdatum
5. April 2001 (05.04.2001)

PCT

(10) Internationale Veröffentlichungsnummer
WO 01/24172 A1

(51) Internationale Patentklassifikation[7]: G11B 7/00

(21) Internationales Aktenzeichen: PCT/EP00/07379

(22) Internationales Anmeldedatum:
31. Juli 2000 (31.07.2000)

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

(30) Angaben zur Priorität:
199 47 782.5 24. September 1999 (24.09.1999) DE

(71) Anmelder *(für alle Bestimmungsstaaten mit Ausnahme von US)*: **BEIERSDORF AG** [DE/DE]; Unnastrasse 48, D-20253 Hamburg (DE).

(72) Erfinder; und

(75) Erfinder/Anmelder *(nur für US)*: **LEIBER, Jörn** [DE/DE]; Mittelstrasse 4, D-25524 Heiligenstedtenerkamp (DE). **MÜSSIG, Bernhard** [DE/DE]; Eddelsener Weg 31, 21218 Seevetal (DE). **STADLER, Stefan** [DE/DE]; Wellingsbütteler Weg 117, 22391 Hamburg (DE).

(74) Anwälte: **BOTH, Georg** usw.; Uexküll & Stolberg, Beselerstrasse 4, D-22607 Hamburg (DE).

(81) Bestimmungsstaaten *(national)*: JP, US.

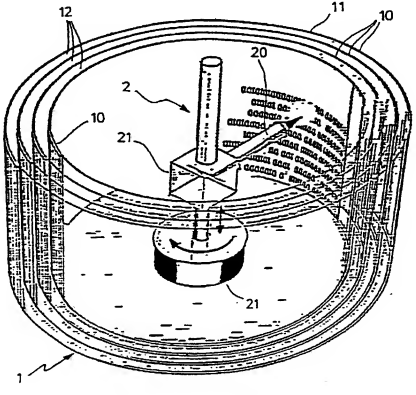
(84) Bestimmungsstaaten *(regional)*: europäisches Patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Veröffentlicht:
— *Mit internationalem Recherchenbericht.*

Zur Erklärung der Zweibuchstaben-Codes, und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

(54) Title: DATA MEMORY

(54) Bezeichnung: DATENSPEICHER



(57) **Abstract:** The invention relates to a data memory comprising an optical information carrier which has several layers (10) of a polymer carrier (11) through which information can be read out of a preselected polymer carrier layer (10) and, optionally, can be written into a preselected polymer carrier layer (10). The information carrier is formed around an optically transparent core whose refractive index differs from the refractive index of the polymer carrier (11) by less than 0.08.

(57) **Zusammenfassung:** Ein Datenspeicher hat einen optischen Informationsträger, der mehrere Lagen (10) eines Polymerträgers (11) aufweist, durch die hindurch Information aus einer vorgewählten Polymerträgerlage (10) auslesbar und optional in eine vorgewählte Polymerträgerlage (10) schreibbar ist. Der Informationsträger ist um einen optisch transparenten Kern ausgebildet, dessen Brechzahl sich um weniger als 0,08 von der Brechzahl des Polymerträgers (11) unterscheidet.

WO 01/24172 A1

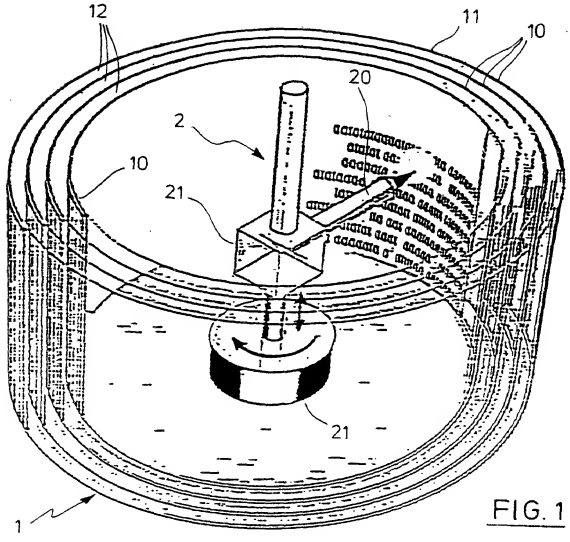


FIG. 1

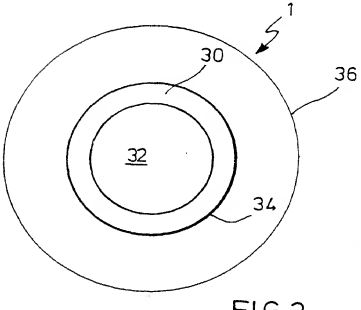


FIG. 2

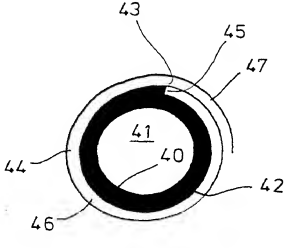


FIG. 3

35-233
P 59700 Bo/HM

RULE 63 (37 C.F.R. 1.63)
INVENTORS DECLARATION FOR PATENT APPLICATION
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

As a below named inventor, I hereby declare that my residence, mailing address and citizenship are as stated below next to my name, and I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

DATA MEMORY

the specification of which (**check** applicable **box(s)**):

☐ is attached hereto
☐ was filed on _____ as U.S. Application Serial No. _____ (Atty Dkt. No. 35-233)
☒ was filed as PCT International application No. PCT/EP00/07379 on 31/07/2000
and (if applicable to U.S. or PCT application) was amended on _____

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose to the Patent Office all information known to me to be material to patentability as defined in 37 C.F.R. 1.56. I hereby claim foreign priority benefits under 35 U.S.C. 119/365 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed or, if no priority is claimed, before the filing date of this application:

Priority Foreign Application(s):

Application Number	Country	Day/Month/Year Filed
199 47 782.5	DE	24/09/1999

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below.

Application Number	Date/Month/Year Filed

I hereby claim the benefit under 35 U.S.C. 120/365 of all prior United States and PCT international applications listed above or below:

Prior U.S./PCT Application(s): Application Serial No.	Day/Month/Year Filed	Status: patented pending, abandoned
PCT/EP00/07379	31/07/2000	

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon. And on behalf of the owner(s) hereof, I hereby appoint **NIXON & VANDERHYE P.C., 1100 North Glebe Rd., 8th Floor, Arlington, VA 22201-4714, telephone number (703) 816-4000 (to whom all communications are to be directed)**, and the following attorneys thereof (of the same address) individually and collectively owner's/owners' attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith and with the resulting patent: Larry S. Nixon, 25640; Arthur R. Crawford, 25327; James T. Hosmer, 30184; Robert W. Faris, 31352; Richard G. Besha, 22770; Mark E. Nusbaum, 32348; Michael J. Keenan, 32106; Bryan H. Davidson, 30251; Stanley C. Spooner, 27393; Leonard C. Mitchard, 29009; Duane M. Byers, 33363; Jeffry H. Nelson, 30481; John R. Lastova, 33149; H. Warren Burnam, Jr. 29366; Mary J. Wilson, 32955; J. Scott Davidson, 33489; Alan M. Kagen, 36176; Robert A. Molan, 29834; B. J. Sadoff, 36663; James D. Berquist, 34776; Updeep S. Gill, 37334; Michael J. Shea, 34725; Donald L. Jackson, 41090; Michelle N. Lester, 32331; Frank P. Presta, 19828; Joseph S. Presta, 35329; Joseph A. Rhoa, 37515; Raymond Y. Mah, 41426; Chris Comuntzis, 31097; Gary T. Tanigawa, 43180. I also authorize Nixon & Vanderhye to delete any attorney names/numbers no longer with the firm and to act and rely solely on instructions directly communicated from the person, assignee, attorney, firm, or other organization sending instructions to Nixon & Vanderhye on behalf of the owner(s).

1. Inventor's Signature: Jörn Leiber Date: July 9, 2002
Inventor: Jorn (first) MI LEIBER (last)* German (citizenship)
Residence: (city) ~~Heiligenstedtenkamp~~ Hamburg (state/country) Germany DEX
Mailing Address: ~~Mittelstrasse 4, Heiligenstedtenkamp, Germany~~ An der Lohbek 6b
(Zip Code) ~~D-25524~~ D-22529

2. Inventor's Signature: Bernhard Mussig Date: July 12, 2002
Inventor: Bernhard (first) MI MUSSIG (last) German (citizenship)
Residence: (city) Seevetal (state/country) Germany DBX
Mailing Address: Eddelsener Weg 31, Seevetal, Germany
(Zip Code) 21218

☒ *See attached sheet(s) for additional inventor(s) information!!*

3. Inventor's Signature: _____ Date: 5.8.2002

Inventor: Stefan (first) MI STADLER (last) German (citizenship)

Residence: (city) Hamburg (state/country) Germany DEX

Mailing Address: ~~Wellingsbuttler Weg 117, Hamburg, Germany~~ Mellenbergweg 1

(Zip Code) ~~22891~~ D-22359

4. Inventor's Signature: _____ Date: 16.7.2002

Inventor: Steffen (first) MI NOEHTE (last) German (citizenship)

Residence: (city) Weinheim (state/country) Germany DEX

Mailing Address: Leberstrasse 51, ~~Hamburg~~, Germany

(Zip Code) D-69469

FOR ADDITIONAL INVENTORS, check box ☐ and attach sheet with same information and signature and date for each.